

# PG&E Facilities Risk Management



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1. Overview of PG&E
2. Pipeline vs. Station Differences
3. How We Identify, Evaluate and Manage Risk
  - At the Fleet Level
  - At the Station Level
  - At the Component Level
4. Opportunities

- **One of the Largest Combined Gas & Electric Utilities in the United States**
  - ~ 20,000 Employees
  - ~ 70,000 Square Mile Service Territory
  - ~ 4.3 Million Gas Customer Accounts
  - ~ 42,000 Miles of Distribution Pipe
  - ~ 6,700 Miles of Transmission Pipe
- **3 Storage Facilities (25% Ownership in a Fourth)**
- **9 Compressor Stations**
  - ~ 212,000 Horsepower
- **~ 450 Transmission Regulation / Metering Stations**
- **3 Terminals**
- **PAS 55, ISO 55001, API 1173, RC 14001 Certified**



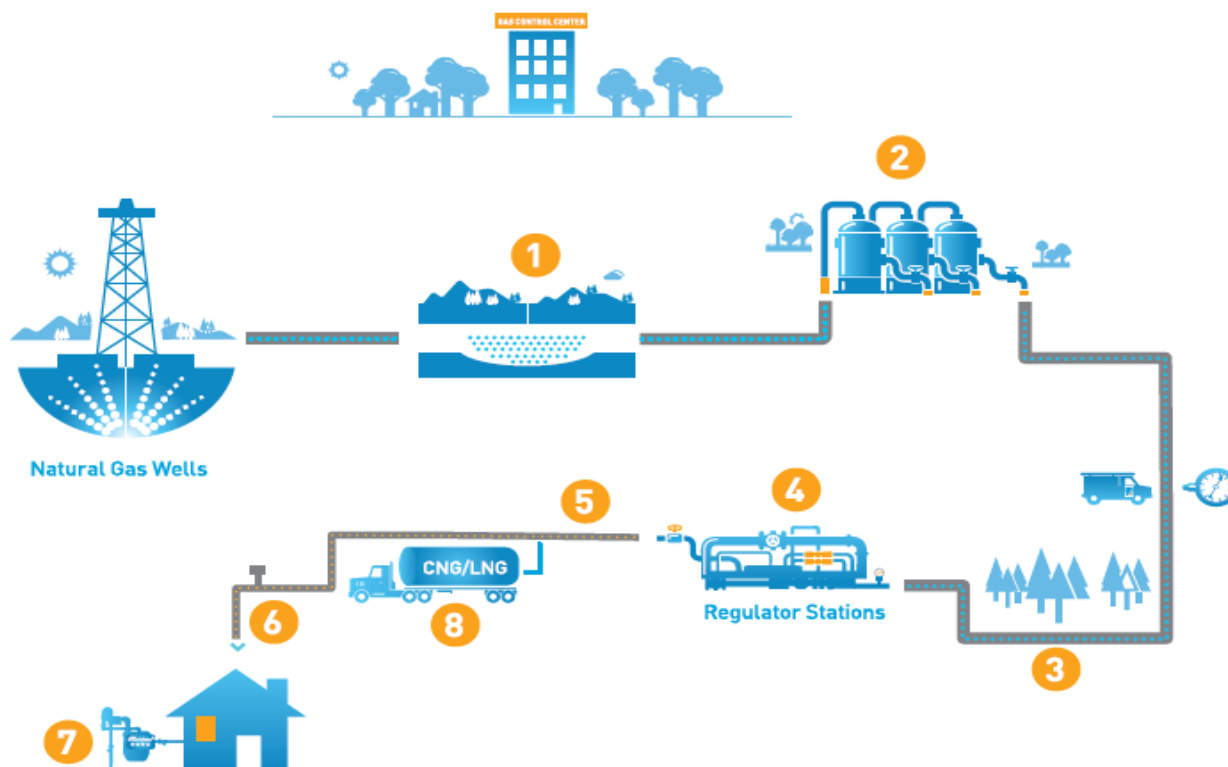


We will be the  
safest, most reliable  
gas company in the  
United States

## Asset Families

- 1 Gas Storage
- 2 Compression & Processing
- 3 Transmission Pipe
- 4 Measurement & Control
- 5 Distribution Mains
- 6 Distribution Services
- 7 Customer-connected Equipment
- 8 Compressed Natural Gas/  
Liquefied Natural Gas

## Natural Gas System Overview Asset Families



# Measurement & Control Asset Family



**Below Ground**



**Above Ground**

**Transmission Regulation / Metering Stations (~450)**



**District Regulator Station  
(~2,400)**

## Additional Assets

- Terminals (3 Facilities)
- Distribution Farm Taps (~2400)

# Compression & Processing Asset Family



**Reciprocating Engines**



**Electric Motors**



**Gas Turbines**

**Compressor Stations (9 Facilities)**



**Processing Facilities (3 Storage Facilities)**

Stations are different than pipe and, therefore, require a different approach

- ✓ Pipeline focus is on integrity risks
- ✓ Station focus must address reliability and integrity risks
- ✓ Station design factor provides higher safety margin
- ✓ In aggregate, facilities have a significantly smaller footprint
  - Geographical overlay of the Potential Impact Radius (PIR) for PG&E's stations is ~1% of its pipeline assets
  - Total pipe length of PG&E's station piping is ~1% of its transmission pipe
  - ~60% of PG&E's station features are accessible for inspection and maintenance as opposed to pipeline that is underground

# Enterprise Integrated Planning Process



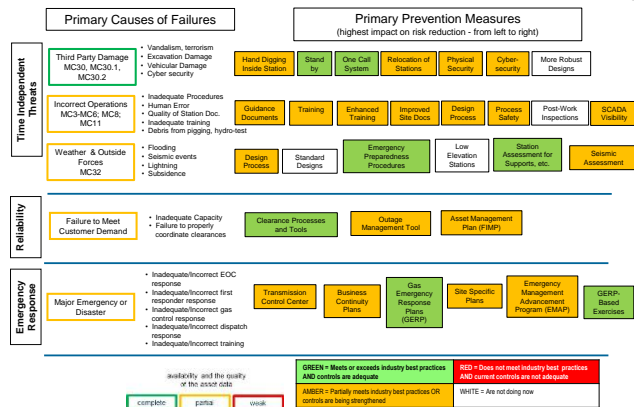


# Identifying, Evaluating and Managing Risk: Fleet Level

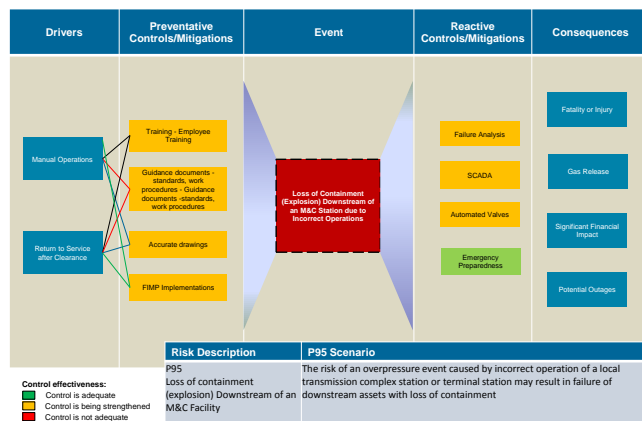
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# How We Identify, Evaluate and Manage Risk Fleet Level

**Threat Matrix  
(Representative)**



**Bow-Ties  
(Example)**



- Fleet level risk management tools
  - Risk Register: Identify, evaluate and prioritize risk
  - Threat Matrices: Identify fleet level mitigation programs
  - Additional assessment of risks and mitigations
    - Fault trees
    - Bow-ties
- Asset management
  - Asset Management Plans
  - Long-term compression investment plan

	Time-Dependent Threats			Stable Threats			Time Independent Threats		
	<i>"The threat level may grow over time if unchecked"</i>			<i>"The threat is inherent but does not grow over time unless acted upon by pressure or external load"</i>			<i>"The threat exists outside of the continuum of time"</i>		
	External Corrosion	Internal Corrosion	Stress Corrosion Cracking	Manufacturing Related Defects	Welding / Fabrication Related	Equipment	Third Party / Mechanical Damage	Incorrect Operations	Weather Related & Outside Forces
Primary CAUSES	1) Transitions 2) Inadequate coating 3) Atmospheric conditions	1) Liquids 2) Sulfur 3) Erosion	Not a high risk for asset family	1) Poor quality manufacture 2) Inadequate specifications 3) Strength test documentation	1) Poor construction practices 2) Inadequate QC/inspection	1) Age, Obsolescence 2) Incorrect sizing/design 3) Maintenance related 4) Sulfur 5) Liquids entering the system 6) Vault flooding (LP)	1) Vandalism 2) Excavation Damage 3) Vehicular Damage 4) Cyber Threat	1) Inadequate procedures 2) Human error 3) Quality of station documentation 4) Inadequate training 5) Debris from pigging & hydrotesting	1) Flooding 2) Seismic events

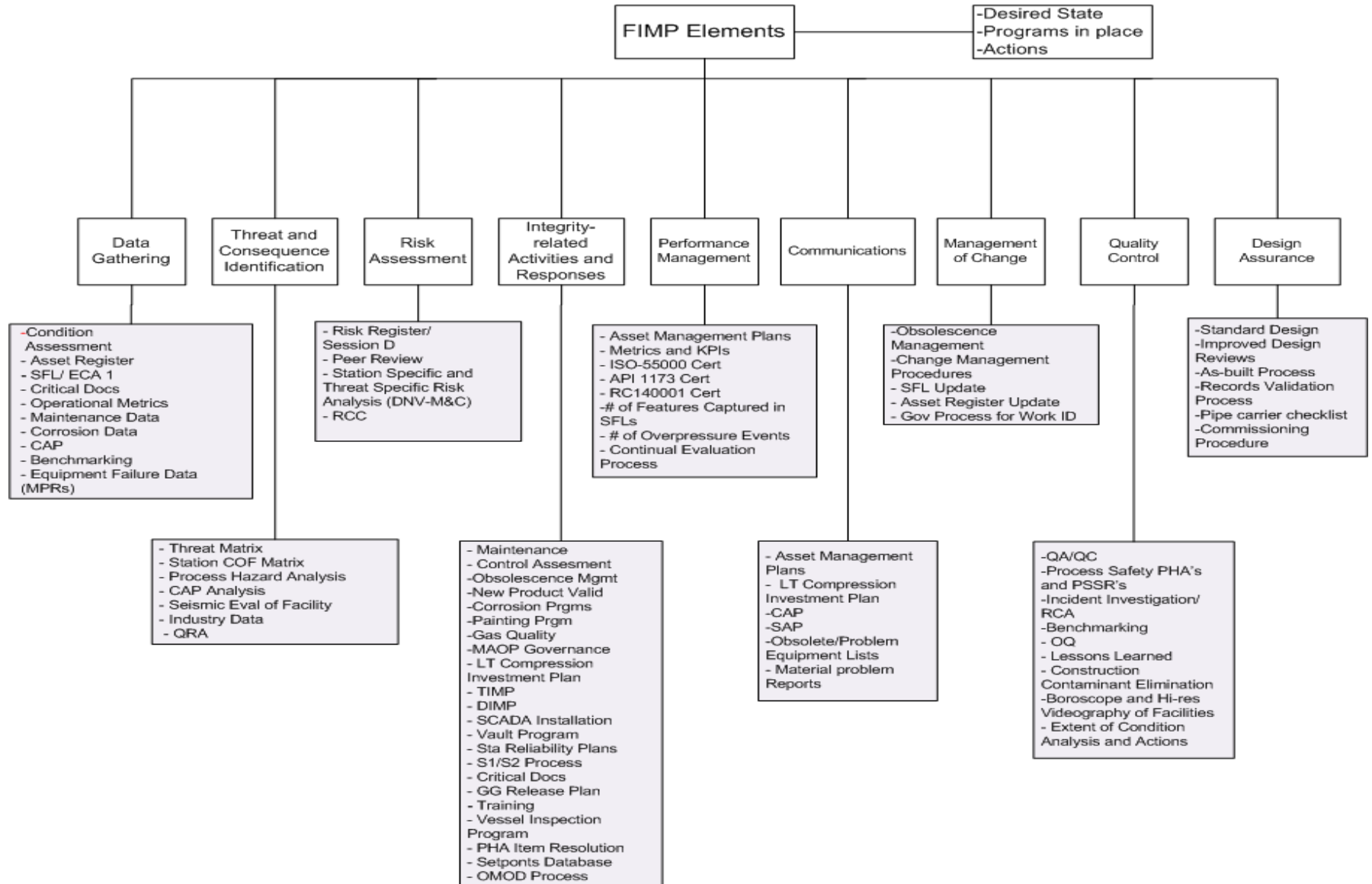
- **PG&E data sources**
  - Event data (Corrective Action Program)
  - Maintenance information
  - Condition assessments
  - Equipment obsolescence information
  - Outage data
  - Root cause analyses
  - Records reviews
  - Subject matter expert perspectives
- **Industry data sources**
  - PHMSA information
  - INGAA / AGA information
  - Benchmarks
  - Third party reviews and assessments

## Risk Register

V2.0 D202140221

			Safe Service Reliable Service Affordable Service						
Frequency Description	Frequency per Year	Frequency Level	Impact Level	Safety	Environmental	Compliance	Reliability	Reputational	Financial
> 10 times per year	F = > 10	Common (7)	Catastrophic (7)	<ul style="list-style-type: none"><li>o <b>Fatalities:</b> Many fatalities and life threatening injuries to the public or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Permanent or long-term damage greater than 100 years; or</li><li>o <b>Hazard Level/Toxicity:</b> Release of toxic material with immediate, acute and irreversible impacts to surrounding environment; or</li><li>o <b>Location:</b> Event causes destruction of a place of international cultural significance; or</li><li>o <b>Size:</b> Event results in extinction of a species.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Action resulting in closure, split, or sale of the Company.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts an entire metropolitan area, including critical customers, or is system-wide; and</li><li>o <b>Duration:</b> Disruption of service of more than a year due to a permanent loss to a nuclear facility, hydro facility, critical gas or electric asset; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts more than 1 millions customers; or</li><li>o <b>ES:</b> 50 million total customer hours, or more than 1 million mwh total load;</li><li>o <b>ES:</b> 10 million total customer hours, or loss of service greater than 5 million therms.</li><li>o <b>ES:</b> 4000% miss of equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Ongoing impacts for more than 10 years; and</li><li>o <b>Media:</b> Event is heavily reported from local through international media outlets and social media channels, with influential third parties dominating media coverage; various inaccurate information is widely reported; or</li><li>o <b>Political:</b> Devastating nationwide broad-based political pressure demanding intense long term outreach to policymakers and key stakeholders; or</li><li>o <b>Customer Satisfaction:</b> Greater than 50% loss of customer satisfaction through survey results; or</li><li>o <b>Company Brand:</b> Relationships are severed and trust is completely lost</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact &gt; \$5 billion in costs; or</li><li>o <b>Capital / Liquidity:</b> Ability to raise capital significantly impacted. Dramatic decrease in stock price of more than 50% for more than one year; or</li><li>o <b>Bankruptcy:</b> Risk of bankruptcy is imminent.</li></ul>
1 - 10 times per year	F = 1 - 10	Regular (6)	Severe (6)	<ul style="list-style-type: none"><li>o <b>Fatalities:</b> Few fatalities and life threatening injuries to the public or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Long-term damage between 11 years and 100 years; or</li><li>o <b>Hazard Level/Toxicity:</b> Release of toxic material with acute and long-term impacts to surrounding environment; or</li><li>o <b>Location:</b> Event causes destruction of a place of national cultural significance; or</li><li>o <b>Size:</b> Event results in elimination of a significant population of a protected species.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Cease and desist orders are delivered by regulators. Critical assets and facilities are forced by regulators to be shutdown.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts multiple critical locations and critical customers; or</li><li>o <b>Duration:</b> Substantial disruption of service greater than 100 days; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts more than 100k customers; or</li><li>o <b>ES:</b> 5 million total customer hours, or more than 100k mwh total load;</li><li>o <b>ES:</b> 1 million total customer hours, or loss of service greater than 500k therms;</li><li>o <b>ES:</b> 2000% miss of equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Ongoing impacts between 1 and 10 years; and</li><li>o <b>Media:</b> Event is heavily reported from local through national media outlets and social media channels, with influential third parties dominating media coverage, and various inaccurate information is widely reported; or</li><li>o <b>Political:</b> Extreme statewide broad-based political pressure demanding concentrated outreach to policymakers and key stakeholders; or</li><li>o <b>Customer Satisfaction:</b> 21% - 50% loss of customer satisfaction through survey results; or</li><li>o <b>Company Brand:</b> Event creates outrage and trust can't be fully recovered</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact between \$500 million and \$5 billion in costs; or</li><li>o <b>Capital / Liquidity:</b> Ability to raise capital is challenged. Dramatic decrease in stock price of more than 25% for more than one year.</li></ul>
Once every 1 - 3 years	F = 1 - 0.3	Frequent (5)	Extensive (5)	<ul style="list-style-type: none"><li>o <b>Permanent/Serious Injuries or Illnesses:</b> Many serious injuries or illnesses to the public or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Medium-term damage between 2 and 10 years; or</li><li>o <b>Hazard Level/Toxicity:</b> Release of toxic material with a significant threat to the environment and/or release with medium-term reversible impact; or</li><li>o <b>Location:</b> Event causes destruction of a place of regional cultural significance; or</li><li>o <b>Size:</b> Event results in harm to multiple individuals of a protected species.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Governmental, regulatory investigations, and enforcement actions, lasting longer than a year. Violations that result in fines or penalties commensurate with the Financial Risk criteria and regulators enforce multiple large non financial sanctions; or</li><li>o <b>Increased Regulatory Oversight:</b> Regulators force the removal and replacement of management positions. Regulators begin Company monitoring activities.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts multiple critical locations or customers; or</li><li>o <b>Duration:</b> Disruption of service greater than 10 days; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts more than 10k customers; or</li><li>o <b>ES:</b> 500k total customer hours, or more than 10k mwh total load;</li><li>o <b>ES:</b> 100k total customer hours, or loss of service greater than 50k therms;</li><li>o <b>ES:</b> 500% miss of equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Ongoing impacts between 1 quarter and 1 year; or</li><li>o <b>Media:</b> Event is widely reported in national media outlets and social media channels, with influential third parties dominating media coverage, and inaccurate information is reported; or</li><li>o <b>Political:</b> Severe territory wide political pressure demanding extensive outreach to policymakers and key stakeholders; or</li><li>o <b>Customer Satisfaction:</b> 4% - 20% loss of customer satisfaction through survey results; or</li><li>o <b>Company Brand:</b> Event creates serious concerns of company management while trust is severely diminished</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact between \$50 million and \$500 million in costs; or</li><li>o <b>Capital / Liquidity:</b> Ability to raise capital is hindered. Dramatic decrease in stock price of more than 10% for up to one year.</li></ul>
Once every 3 - 10 years	F = 0.3 - 0.1	Occasional (4)	Major (4)	<ul style="list-style-type: none"><li>o <b>Permanent/Serious injuries or illnesses:</b> Few serious injuries or illnesses to the public or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Short-term damage of up to 2 years; or</li><li>o <b>Hazard Level/Toxicity:</b> Release of material with a significant threat to the environment and/or release with short-term reversible impact; or</li><li>o <b>Location:</b> Event causes destruction of an individual cultural site; or</li><li>o <b>Size:</b> Event results in harm to a single individual of a protected species.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Violations that result in fines or penalties commensurate with the Financial Risk criteria, or a regulator enforces non financial sanctions; or</li><li>o <b>Expanded Regulations:</b> Significant new and updated regulations are enacted as a result of an event.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts a single critical location; or</li><li>o <b>Duration:</b> Disruption of service greater than 1 day; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts more than 3k customers; or</li><li>o <b>ES:</b> 50k total customer hours, or more than 1k mwh total load;</li><li>o <b>ES:</b> 10k total customer hours, or loss of service greater than 5k therms;</li><li>o <b>ES:</b> 100% miss of equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Ongoing impacts between 1 week and 1 quarter; or</li><li>o <b>Media:</b> Event is heavily reported in local through national media outlets and social media channels, with influential third parties dominating media coverage, and inaccurate information is reported; or</li><li>o <b>Political:</b> Major territory wide political pressure demanding major outreach to policymakers and key stakeholders; or</li><li>o <b>Customer Satisfaction:</b> 1% - 3% loss of customer satisfaction through survey results; or</li><li>o <b>Company Brand:</b> Management is questioned and trust is diminished</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact between \$5 million and \$50 million in costs.</li></ul>
Once every 10 - 30 years	F = 0.1 - 0.033	Infrequent (3)	Moderate (3)	<ul style="list-style-type: none"><li>o <b>Minor Injuries or illnesses:</b> Minor injuries or illnesses to many public members or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Short-term damage of a few months; or</li><li>o <b>Hazard Level/Toxicity:</b> Release of material with a moderate threat to the environment and/or release with short-term reversible impact; or</li><li>o <b>Location:</b> Event causes damage to an individual cultural site; or</li><li>o <b>Size:</b> Event results in damage to the known habitat of a protected species.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Violations that result in fines or penalties commensurate with the Financial Risk criteria.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts a small area with no disruption of service to critical locations; or</li><li>o <b>Duration:</b> Disruption of service of up to 1 full day; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts more than 100 customers; or</li><li>o <b>ES:</b> 5k total customer hours, or more than 100 mwh total load;</li><li>o <b>ES:</b> 1k total customer hours, or loss of service greater than 500 therms;</li><li>o <b>ES:</b> 50% miss of ES equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Short term coverage for up to 1 week.</li><li>o <b>Media:</b> Event is reported in multiple local media outlets and/or social media channels, with limited exposure beyond the coverage area; or</li><li>o <b>Political:</b> Moderate county level political pressure demanding moderate outreach to policymakers and key stakeholders; or</li><li>o <b>Customer Satisfaction:</b> Less than 1% loss of customer satisfaction through survey results; or</li><li>o <b>Company Brand:</b> Event isn't anticipated and trust is impacted; or</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact between \$500k and \$5 million in costs.</li></ul>
Once every 30 - 100 years	F = 0.033 - 0.01	Rare (2)	Minor (2)	<ul style="list-style-type: none"><li>o <b>Minor injuries or illnesses:</b> Minor injuries or illnesses to few public members or employees.</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Immediately correctable; or contained within a small area.</li></ul>	<ul style="list-style-type: none"><li>o <b>Adverse Regulatory Actions:</b> Self-reported or regulator identified violations with no fines or penalties.</li></ul>	<ul style="list-style-type: none"><li>o <b>Location:</b> Impacts a small localized area with no disruption of service to critical locations; or</li><li>o <b>Duration:</b> Disruption of up to 3 hours; or</li><li>o <b>Customer Impact:</b> Unplanned outage (net of replacement) impacts less than 100 customers; or</li><li>o <b>ES:</b> Less than 5k total customer hours, or less than 100 mwh total load;</li><li>o <b>ES:</b> Less than 1k total customer hours, or loss of service less than 500 therms;</li><li>o <b>ES:</b> 5% miss of ES equivalent forced outage factor and/or availability target</li></ul>	<ul style="list-style-type: none"><li>o <b>Duration:</b> Single report of the event.</li><li>o <b>Media:</b> Event is reported in a single local media outlet in the location where the event took place; or</li><li>o <b>Political:</b> Minimal political pressure demanding minimal outreach to policymakers and key stakeholders; or</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact between \$50k and \$500k in costs.</li></ul>
Once every 100 - 300 years	F = <0.01	Remote (1)	Negligible (1)	<ul style="list-style-type: none"><li>o No injury or illness or up to an un-reported negligible injury.</li></ul>	<ul style="list-style-type: none"><li>o Negligible to no damage to the environment.</li></ul>	<ul style="list-style-type: none"><li>o No compliance impact up to an administrative impact.</li></ul>	<ul style="list-style-type: none"><li>o No reliability to negligible impacts.</li></ul>	<ul style="list-style-type: none"><li>o No known reputation impact reported to a non featured report.</li></ul>	<ul style="list-style-type: none"><li>o <b>Financial Costs:</b> Damage to third party properties, loss of assets and facilities, fines, lawsuits, restitution, remediation, restoration, cost of replacement energy, redistributed customer costs, amounting to a total impact of less than \$50k in costs.</li></ul>

### Facilities Integrity Management Plan (based on PRCI)





# Identifying, Evaluating and Managing Risk: Station Level


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# How We Identify, Evaluate and Manage Risk Station Level

- Activities currently addressing risk on a station basis
  - Condition assessment
  - Operational testing and repairs
  - Process Safety Management
  - Project prioritization
  - Additional programs

Facility Name	Equipment Item	Equipment Description	Equipment Grade	Equipment Type	Equipment Class	Weighting Factor	Station Grade
HARRIS RD REGULATOR STA	V-7	VALVE - ACTUATED	4.85	MONITOR	1	100%	69.00
	F-2	GAS FILTER / SEPARATOR	4.10	FILTER	2	50%	
	V-1	VALVE - MANUAL	3.94	VALVE	3	0%	
	V-10	VALVE - MANUAL	4.10	VALVE	3	0%	
	V-11	VALVE - ACTUATED	4.85	REGULATOR	1	100%	
	V-12	VALVE - ACTUATED	4.85	REGULATOR	1	100%	
	V-17.26	VALVE - MANUAL	4.10	VALVE	3	0%	
	V-2	VALVE - MANUAL	4.10				
	V-27.74	VALVE - MANUAL	3.94				
	V-3	VALVE - MANUAL	4.10				
	V-4	VALVE - MANUAL	4.70				
	V-5	VALVE - MANUAL	4.70				
	F-1	GAS FILTER / SEPARATOR	4.10				
	V-65.70	VALVE - MANUAL	3.94				
	RTU	REMOTE TERMINAL UNIT	3.10				
	V-8	VALVE - MANUAL	4.10				
	V-9	VALVE - MANUAL	4.70				
	V-C	VALVE - MANUAL	4.54				
	V-D	VALVE - MANUAL	4.54				
	V-E	VALVE - MANUAL	3.94				
	V-F	VALVE - MANUAL	4.10				
	PIPE	PIPE - STATION	4.10				
	M-1	METER - ORIFICE	4.10				
	PT-1	TRANSMITTER - PRESSURE	3.10				
	PT-2	TRANSMITTER - PRESSURE	3.10				
	PT-3	TRANSMITTER - PRESSURE	3.10				
	FT-1	TRANSMITTER - FLOW	3.10				
	V-6	VALVE - ACTUATED	4.85				

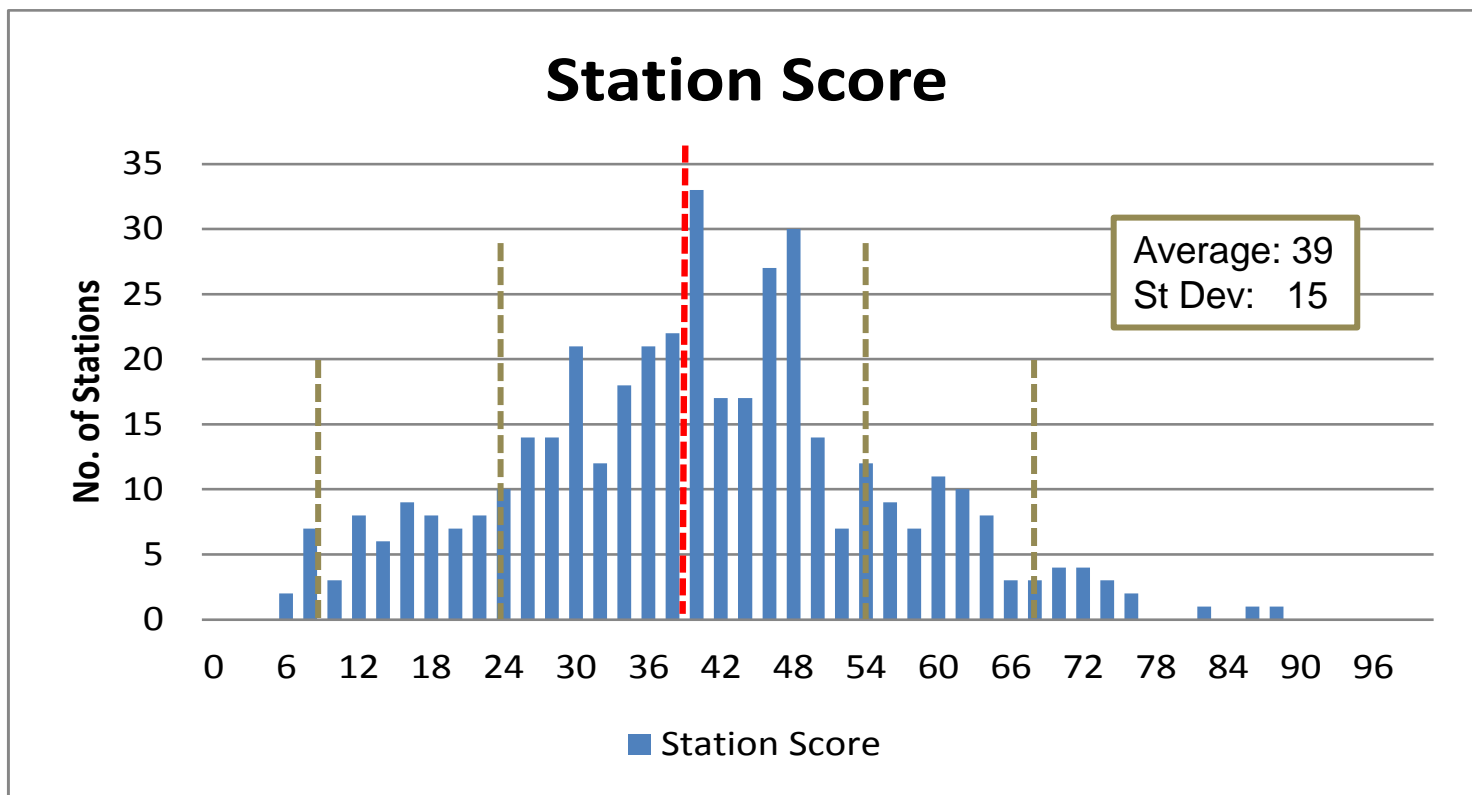
  

Equipment No.	Equipment Description (Manufacturer / Model)	Metric Definition	Metric Score	Weighting Factor	Equipment Grade	Manufacturer / Model Equipment Photo
V-11	VALVE - ACTUATED (0-0)				4.85	
	Age	Age of equipment from installation and based on % of expected equipment life	10	10%		
	Manufacturer / Model (Obsolete Equipment)	Manufacturer and model; current status of equipment item in industry (still made, spare parts available, etc.)	10	15%		
	Manufacturer / Model (Problem Equipment)	Manufacturer and model; equipment identified as problem item by maintenance	1	15%		
	Physical Condition (from visual inspection)	Condition based on visual inspection	1	15%		
	Functional Performance (from trending tests)	Condition based on operational performance or functional tests	5	25%		
	Operational Efficiency	Measure of operational efficiency measured by energy costs, labor, or operation attention	1	4%		
	Engineered maintenance strategy	Preventive or condition based tasks assigned for equipment	7	4%		
	Number of Corrective Maintenance	Number of corrective maintenance tasks on the equipment	1	4%		
	% Preventive Maintenance Overdue	% of preventive or condition based maintenance tasks overdue	10	4%		
	% (Corrective Maintenance / Total Maintenance)	% of corrective maintenance work hours to total maintenance work hours	1	4%		

Station Score Sheet

Component Score Sheet

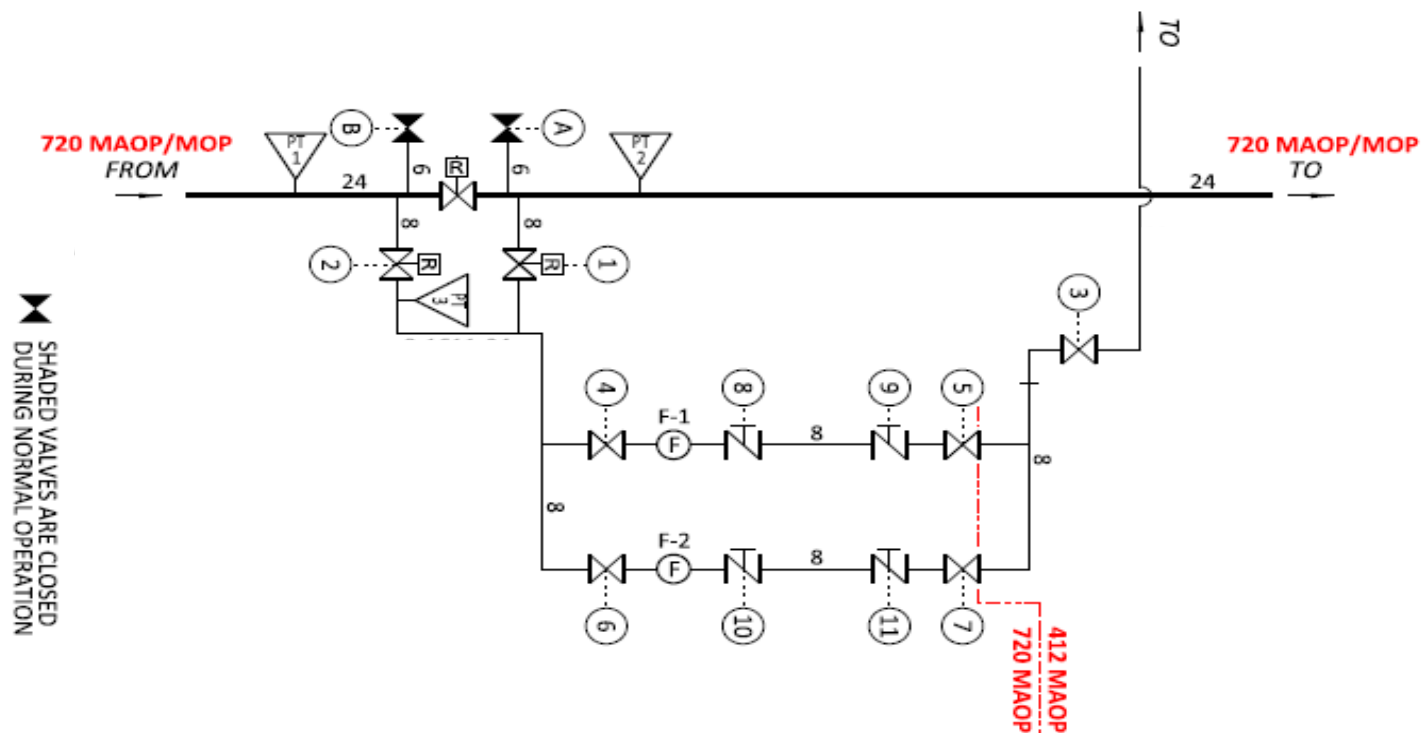
# How We Identify and Evaluate Risk Station Level



Components in Station	COF for H&S or Reliability of 5 or Greater		COF for H&S and Reliability of Less Than 5	
	Target Score	No. of Stations	Target Score	No. of Stations
<b>Class 1 and 2 (Cat. X)</b>	54.8	234	65.4	149
<b>Class 1 Only (Cat. XA)</b>	36.5	17	43.6	28
<b>Class 2 Only (Cat. XB)</b>	18.3	8	21.8	29

**Station Target Scores Based on Consequence of Failure for  
Health & Safety and Reliability**

- Automated scoring of station condition assessment
- Risk calculated at the individual station level rather than the fleet level
  - Probability of failure based on equipment fragility data, asset condition, station configuration, location (seismic and liquefaction) and operational data
  - Consequence of failure based on occupancy counts and system connectivity
  - Updated annually






# Identifying, Evaluating and Managing Risk: Component Level

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## Facility Integrity Verification Process (IVP)

- Sequenced to follow the completion of the company's line pipe IVP
  - Prioritized in alignment with 'Pipeline vs. Station Differences' on slide 8
- Multiple programs filed as part of PG&E's 2015-2018 Gas Transmission and Storage Rate Case with the California Public Utility Commission

## Engineering Critical Assessment – Phase 1 (ECA 1)

- Comprehensive evaluation of more than 80K distinct features to re-confirm MAOP and identify design related asset integrity issues
  - Stations sequenced by relative risk ranking and operational constraints
  - Involves the application of Sound Engineering Judgement
  - Evaluation activities may include field investigations
  - Non-conformances in design will be mitigated
- 
- A close-up photograph of a metal pipe or valve. The letters 'ST' are embossed on the metal surface. A dark, possibly black, object is visible in the upper right corner of the image.

LINE	ITEM	QIP-Opening Station ID	Station Name	LINE	LINE	Station Type	QIP-Opening Station	QIP-Opening Date	QIP-Opening Status
Feature ID	Feature Description	Feature Location	Feature Name	Feature Type	Feature Number	Feature Date	Feature Status	Feature Date	Feature Status
21	Pipe	No Casing	1956176	05/12/1993	2				

Feature Number	Feature	Feature Type	Job Number	Install Date	STPR Number	OD1 (in)	WT1 (in)
21	Pipe	No Casing	1956176	05/12/1993	2	16	0.656
22	Mfg Bend	Unknown	1956176	05/12/1993	2	16	0.656
23	Pipe	No Casing	1956176	05/12/1993	2	16	0.656
24	Reducer	Conc.-Std	1956176	05/12/1993	2	16	0.656
25	Tee	Reducing Tee	1956176	05/12/1993	2	20	0.5

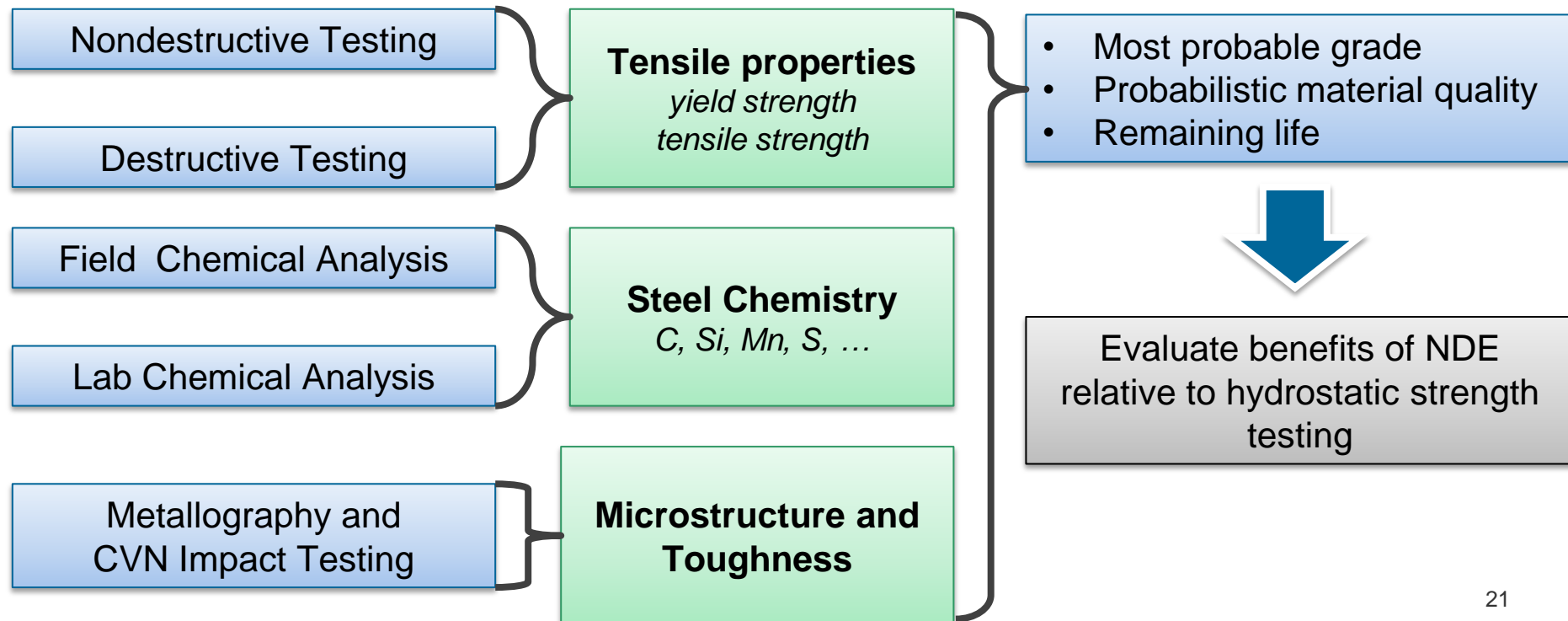
Engineering Critical Analysis - Calculated Results				
MAOP Computation and Selection				
MAOP per Design (psig)	MAOP per Test (psig)	Limiting MAOP Value (psig)	%SMYS @ Limiting MAOP Value	Limiting MAOP Mod
1435	1333	1040	36.2%	R
1435	1333	1040	36.2%	R
1435	1333	1040	36.2%	R
1300	1333	1040	40.0%	R
1300	1333	1040	40.0%	R



Field Investigation:  
Markings identify flanges  
as 1930's Vintage  
MWP 600 vs. MWP 720

## Engineering Critical Assessment – Phase 2 (ECA 2)

- Mitigation of discrepancies in strength test coverage identified during ECA 1 via low-risk and non-disruptive methodologies
- Under development in partnership with industry experts across multiple disciplines
- Places greater emphasis on probabilistic, rather than deterministic, modeling

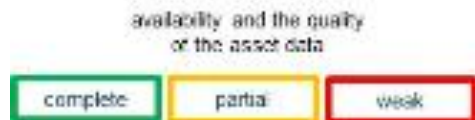
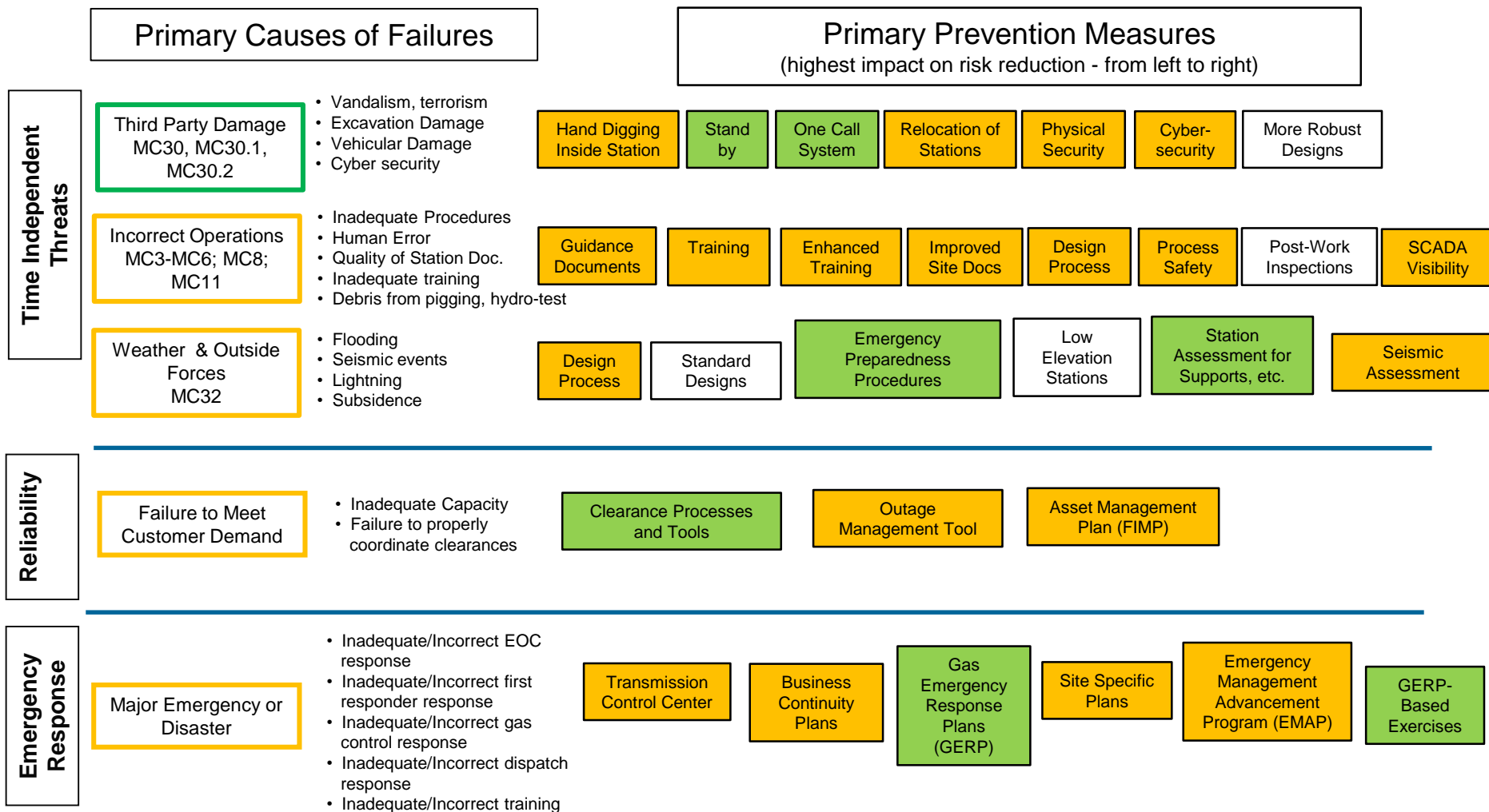


- Individual utilities have no or few occurrences of high consequence events limiting the ability to perform quantitative or probabilistic risk analysis. A universal set of industry level data is needed.
- Equipment failure rate data is not available to determine likelihood of failure. Determination of component or design risk is not precise.



# Appendix

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GREEN = Meets or exceeds industry best practices AND controls are adequate	RED = Does not meet industry best practices AND current controls are not adequate
AMBER = Partially meets industry best practices OR controls are being strengthened	WHITE = Are not doing now

